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Nutrient Level of a Young Tropical Hydroelectric Dam Reservoir in Sarawak, Malaysia

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ABSTRACT

Monitoring the nutrient level of a reservoir is crucial as excess nutrients can lead to hypoxia and fish kills in the reservoir. Hence, this study was carried out to examine the nutrient level of the Bakun reservoir, which is a newly built hydroelectric reservoir in Sarawak, Malaysia. Water samples were taken at five stations in the reservoir at three different depths (surface layer, 10 m, and 20 m) in November 2013. The present study demonstrated that Bakun reservoir contained low nitrite-nitrogen (≈ 0.005 mg/L) and nitrate-nitrogen (≈ 0.005 mg/L) concentrations but high five-day biochemical oxygen demand (≈ 4.73 mg/L) and organic Kjeldahl nitrogen (≈ 0.16 mg/L) concentrations indicating that organic pollution occurred in the reservoir. On the other hand, a mean total phosphorus concentration of 98.3 µg/L in the Bakun reservoir complied with the 200 µg/L standard value of Class II according to National Water Quality Standards in Malaysia. The nutrient level in the Bakun reservoir differed according to sampling stations and depths. Samplings stations located at Murum River downstream of the Murum dam construction site showed peak value of turbidity (182 FNU) and organic Kjeldahl nitrogen (0.45 mg/L) particularly at deeper water column. Batang Balui and Linau River were observed with higher five-day biochemical oxygen demand (> 6 mg/L) compared to other stations. Station near to the Bakun hydroelectric dam contained relatively high nitrite-nitrogen and total phosphorus concentrations but low nitrate-nitrogen and organic Kjeldahl nitrogen concentrations. Anthropogenic activities such as floating house and Murum dam construction have influenced the nutrients level in the reservoir.

Keywords: Bakun hydroelectric reservoir, dam construction, nitrogen, phosphorus, turbidity

INTRODUCTION

Nutrient level of a reservoir is an important indicator as it indicates the health status of an ecosystem, which supports the life of aquatic organisms (Rabalais, 2002; Camargo *et al*., 2005; Camargo & Alonso, 2006; Schneider *et al*., 2014). High nutrient content in organic or inorganic forms due to the anthropogenic input is the main cause of eutrophication that can lead to fish kills in the reservoir. The study of nitrite and nitrate concentrations in water is often overlooked, giving more importance to the study of ammonia due to the toxicity of unionized ammonia to aquatic organism. Nevertheless, algae bloom can also be induced by high level of nitrite and nitrate as phytoplankton is able to utilize different forms of nitrogen. High level of nitrite and nitrate in water can also cause considerable stress in aquatic organisms (Jensen, 2003; Das *et al*., 2004; Hamlin, 2006).

The nutrient level of a reservoir can change over time when it ages and continuously receives loads of pollutants (Rossel & de la Fuente, 2015). As a young tropical hydroelectric reservoir in Sarawak, the Bakun reservoir covers approximately 1.5 million ha of catchment mainly the Balui River that is fed by three major tributaries, namely, Bahau River, Linau River and Murum River. The reservoir is surrounded by anthropogenic activities from timber harvesting and oil palm plantation to Murum dam construction, which is cascading to Bakun dam, making it susceptible to water quality degradation (Nyanti *et al*., 2012a; Nyanti *et al*., 2015; Ling *et al*., 2015).

Although the Bakun dam reservoir currently serves as a single-purpose hydropower dam, there is a growing interest to further explore the reservoir for recreation and aquaculture activities.